Virtual Magnetospheric Observatory

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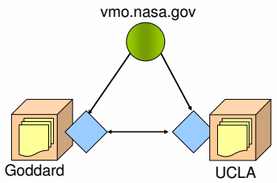
Aspects of the Virtual Magnetospheric Observatory (VMO)

Purpose

- Provide a single access point (portal) for all data repositories needed for magnetospheric research.
- Provide tools for describing data archives.
- Provide tools for registering and advertising resources.
- Identify and register magnetospheric resources.
- Provide services or access to existing services to reformat, manipulate, analyze and display data.
- Contribute to establishing standards for the space physics community.

Why Two VMOs?

Two independent groups were selected to implement and build-up the Virtual Magnetospheric Observatory. The two efforts are complementary and we are pursuing an integrated approach.



Datasets to be Made Available

UCLA as Lead

Mission Data
- Weygand/McPherron database
  (Contains data from: ACE, Geotail, IMP8, Interball, ISEE1, ISEE2, ISEE3, Wind)
- IMP8
- FAST
- Geotail
- ISEE (Magnetometer and Plasma)
- Cluster
- THEMIS (Ground)
- Polar

Resident Archives
- SAMPEX
- ViRBO

Ground Station
- McMAC
- Carisma
- Ultima

… and more

Goddard as Lead

Mission Data
- AMPTE (CCE, IRM, UKS)
- GOES 5-12
- IMP 8
- Interball-Tail
- PAPCO
- ST-5
- SCATHA
- Geotail
- ISEE (WAPS)
- Polar (TIMAS)
- CPI
- THEMIS (S/C)
- Wind (SWE)
- Prognoz-10

Building Blocks

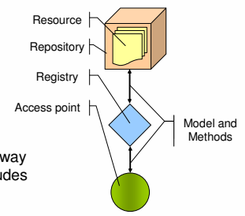
Components

Resource: An object (document, data, etc.) or service available for use.

Repository: A facility for storing and maintaining digital information in accessible form

Registry: A collection point for metadata about resources.

Access Point: An interface to the registries and resources.



The glue that binds:

Data Model: Describes in an abstract way how data is represented. This includes semantics (meaning of terms) and ontology (relationships).

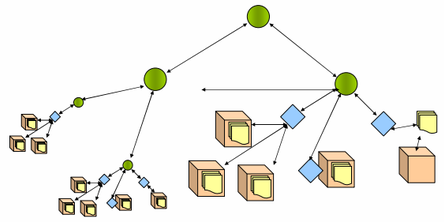
Access Methods: Mechanisms to search for, use and distribute resources.

Architecture

Resources are available at a variety of locations. This includes resident archives, mission or project databases, the VMO, other virtual observatories and distribution sites at a researcher's institution.

Resources are registered with the VMO by publishing a SPASE resource description which the VMO harvests.

Registries can exist in multiple locations. A Registry can be located at the same site of the resource (repository) or at a separate location. A Registry can contain information from multiple repositories.



Overview

The Virtual Magnetospheric Observatory (VMO) collects information on the world's relevant data resources to provide one-stop shopping for the magnetospheric researcher seeking data. The VMO includes data from a wide spectrum of sources ranging from ground stations to spacecraft and includes value added derivatives created by analysis programs and individual researchers. The VMO is being implemented by using existing and widely adopted technologies as well as community based standards. The VMO also provides access to value-added services (e.g. to reformat, manipulate analyze and display data) developed both locally and remotely. The registries for both data and services are designed to make it easy for suppliers to make their resources available and update information regarding the resources. The basis for resource descriptions is the SPASE data model. Tools and services provided by the VMO are made available to the community so that the features of the VMO can be replicated in other environments.

The goals of the Virtual Magnetospheric Observatory complement the ground and space based objectives of the THEMIS mission. Through the VMO the THEMIS mission can access related data to enhance its research. THEMIS can also make available through the VMO resources it releases to the community.

Resource Descriptions and Advertising

Resource Descriptions

A resource description is a collection of metadata which captures the essential attributes of a resource. To enable interoperability and easy data sharing the metadata should be based on a well-defined and controlled vocabulary. The VMO (and the other VxO) have chosen the SPASE data model and dictionary expressed in XML.

Resource Types

Person
An individual human being.

Observatory
The host (spacecraft, network, facility) for instruments making observations.

Instrument
A device which is used to sense and parameterize a physical phenomenon.

Catalog
A tabular listing of events or observational notes, especially those that have utility in aiding a user in locating data. Catalogues include lists of events, files in a product, and data availability.

Display Data
A graphical representation of data wherein the underlying numeric values are not (readily) accessible for analysis.. Examples are line plots and spectrograms.

Numerical Data
Data stored as numerical values in a specified format.

Granule
An accessible portion of another resource. The ParentID of a Granule resource must be a NumericalData resource. The attributes of a Granule supersede the corresponding attributes in the NumericalData resource.

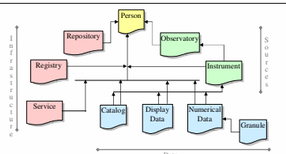
Registry
A location or facility where resources are cataloged.

Repository
A location or facility where resources are stored.

Service
A location or facility that can perform a well defined task.

All definitions from the SPASE data dictionary (http://www.spase-group.org)

Resource Relationships



The association map between resources in the SPASE model. Arrows point in the direction of association. Resources are defined from top to bottom: Person first, Granule last.

Steps to Creating a Resource Description

To reduce redundancies and eliminate the need for multiple updates resource descriptions reference other resources. This means there's a natural order for creating resource descriptions. That order is:

1. **Person**
2. **Observatory**
3. **Instrument**
4. **NumericalData, DisplayData, Catalog**
5. **Granule**

Other resources such as **Registry**, **Repository** and **Service** can be created after any needed Person resources exist.

Resource Types

Validator
Determines compliance with the SPASE data model.

Editor
The web SPASE XML editor can be used to create or alter SPASE XML descriptions.

Parser
The SPASE XML parser is a collection of Java classes which can parse XML descriptions and load the information into a directly accessible form..

Registry Server
Harvest resource descriptions and provide search services for web applications.

Ruleset Processor
Create SPASE descriptions using external sources of information.

All tools are available from the SPASE we site (http://www.spase-group.org)

Example Resource Descriptions

```
<?xml version="1.0" encoding="UTF-8" ?>
<Spase xmlns="http://www.spase-group.org/data/schema/spase-1_1_0.xsd">
  <Version>1.1.0</Version>
  <Person>
     <ResourceID>SPASE://Contact/JohnSmith</ResourceID>
     <ReleaseDate>2006-09-01T00:00:00</ReleaseDate>
     <PersonName>John Smith</PersonName>
     <OrganizationName>SPASE</OrganizationName>
     <Address>One SPASE Way, USA</Address>
     <Email>John.Smith@spase-group.org</Email>
     <PhoneNumber>1-555-555-1212</PhoneNumber>
  </Person>
</Spase>
```

Advertising a Resource

There are a variety of ways to advertise a resources.

1. **Post the description** at a web accessible location and let a registry know where to look. The registry can then retrieve the description and can revisit the location on a regular interval.
2. **Upload the description** to a registry.
3. **Establish your own registry** and let others know it exists.

Conclusions

- The resources made available through the VMO will complement the data collected by the THEMIS project.
- While THEMIS is preparing for its active mission the VMO will be building-up access to relevant resources.
- During the active mission the VMO will continue to add resources to its inventory.
- The VMO can be used as an alternative path to (public) THEMIS data.

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